

Responders provide technical expertise in case of nuclear weapons accidents

Experts from Sandia, other national labs keep the public safe



FRESH RESPONSE — Ryan Kristensen, a manager in Sandia’s mission assurance center, stands next to a Polaris missile at the National Museum of Nuclear Science and History. As a skilled engineer and recent addition to the Accident Response Group, Ryan brings a fresh perspective to group, colleagues say. (Photo by Randy Montoya)

By Mollie Rappe

Decades ago, technical experts from the national labs responded in an ad hoc manner to accidents involving nuclear weapons, called “broken arrows.” Thirty-two such accidents have occurred since the 1950s, so the Accident Response Group was created about five decades ago to provide technical expertise in assessing and safely resolving nuclear weapons accidents. “With the resources the Department of Energy can bring in the form of ARG, rest assured there will be a safe weapon recovery,” said Harry Cincotta, ARG project lead at Sandia. “If ARG does have to respond, we are ready, and we’re bringing the best scientific minds in nuclear weapons on the planet with us.” Although U.S. nuclear weapons are managed with great care in maintenance and transportation, ARG’s manager Bill Beenau said ARG is prepared to respond in the event of any extraordinary circumstance. ARG leadership recently celebrated the realignment of the ARG program into the Military Liaison Department. The realignment will build off of the existing relationships the Military Liaison Department has with the Department of Defense, and enhance ARG’s technical relationships with DoD maintenance and explosive

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SandiaLabNews

Managed by NTESS LLC for the National Nuclear Security Administration



Vol. 70, No. 24
Nov. 23, 2018

CRADA enables resilient microgrid research between Sandia, Emera Technologies

By Manette Newbold Fisher

Imagine a hurricane similar in magnitude to 2017’s Maria that pummels islands and small communities, stripping out power lines and wreaking havoc on residents’ lives. Only imagine this time around that the local power system withstands the storm, supplying power to communities reeling in devastation. That is one of the goals of a Cooperative Research and Development Agreement between Sandia and Emera Technologies, which is part of Emera Inc., an energy and services company headquartered in Canada. The 18-month CRADA was signed this summer. Sandia and Emera Technologies are working on microgrids, small-scale versions of interconnected electric grids that locally manage energy storage and resources, such as solar, wind and thermal systems, and which may connect to a larger host grid. One of the many advantages of microgrids is they can provide clean, independent and more resilient power generation and storage. Emera Technologies approached Sandia to work together to bring clean, community-scale direct current microgrids into the mainstream, said Sandia program manager Abraham Ellis. “Alternating current microgrids are increasingly being used throughout the world, but a large and growing portion of generation, storage and electricity use in homes is DC, requiring a conversion from AC to DC to make everything work,” Emera Technologies CEO Rob Bennett said. “In the future, I feel all the unnecessary conversion will go

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THE FUTURE OF ENERGY — Sandia manager Abraham Ellis and technologist Roy Lopez discuss future energy technologies research in Sandia’s Distributed Energy Technologies Laboratory. Sandia and Emera Technologies, an Emera company, signed a Cooperative Research and Development Agreement that enables them to share tools and research focused on future energy microgrids. (Photo by Randy Montoya)

CRADA boom spurs innovation, collaboration with Sandia Labs

Number of agreements highest since the turn of the century



ENERGY BOOST — Manager Abraham Ellis works in Sandia’s Distributed Energy Technologies Laboratory. Ellis is a lead researcher on the Cooperative Research and Development Agreement with Emera Technologies Ltd. (Photo by Randy Montoya)

By Michael J. Baker

Sandia signed more Cooperative Research and Development Agreements this past fiscal year than in any previous year this century, sparking dozens of new collaborations and potential technological innovations. “CRADAs are one of the crown jewels of the technology transfer industry,” said Sandia business development specialist Jason Martinez. “Sandia is out there helping companies and fulfilling the Department of Energy tech transfer mission,” he said. “It’s beneficial not only to Sandia, but to the DOE and ultimately the U.S. economy.” A CRADA is an agreement between a government agency and a nonfederal entity to work together on research and development. Sandia signed 42 CRADAs in fiscal year 2018, which ended Sept. 30. In fiscal year 2017, 41 such agreements were executed. The contract value of these 83 new CRADAs, which includes in-kind and government dollars, was more than \$63 million. “This is the first time since 1995 and 1996 we’ve had 40-plus CRADAs in back-to-back years,” Jason said. “We’ve been on an upward trend since 2014. It’s become the new paradigm that we’re executing a higher number of CRADAs.”

CRADAs past and future

Sandia has about 155 active CRADAs. Fiscal year 2018’s crop of new agreements includes small businesses, educational institutions, local businesses, nonprofits and large international agencies. “Our CRADA portfolio is diverse — from energy focused collaborations to

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My story:

Positive energy, opportunities highlight Native American Heritage Month

By Rachael Gutierrez

Focusing on positive energy, recognizing opportunities, and remembering where I came from have been my guiding principles for as long as I can remember. As our country celebrates National Native American Heritage Month in November, I'd like to encourage everyone at Sandia to direct energy toward creating positive environments that make the world a better place.



NATIVE MONTH — Rachael Gutierrez says Sandia's American Indian Outreach Committee does an outstanding job of providing resources for anyone of Native American heritage. (Photo by Brent Haglund)

As Sandians, we are fortunate to have groups that help promote diversity and inclusion. Sandia's American Indian Outreach Committee does an outstanding job of providing resources for anyone of Native American heritage. The committee shares ideas, plans events and encourages the participation of anyone interested in learning and connecting with Native American heritage. Working closely with the American Indian Science and Engineering Society, the committee aims to increase the representation of Native Americans in STEM studies and careers.

No place like home

My ancestors were one of the 12 original families of the Yomba Shoshone Tribe to live on the Yomba Reservation in central Nevada. I always tell people that the reservation, which is located off the loneliest highway in the Reese River Valley, can be found only by those who know what they're looking for. (Hint: The closest town is Austin.) There are roughly 150 members of the Yomba Shoshone Tribe, which is a federally recognized tribal government.

As I grew up in Sacramento, my family would make the most of our long trips to the reservation, bringing food, water and supplies to share with our relatives. I now visit the Yomba Reservation at least twice a year. I value the opportunity to connect with my tribe's traditions and culture. I am interested in learning my tribe's

Lab News Notes

Editor's Note: Lab News seeks guest columnists with observations on life at the Labs or on science and technology in the news and in contemporary life. If you have a column (500-750 words) or an idea to submit, please contact Jim Danneskiold, the acting editor.

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Amarillo, Texas • Carlsbad, New Mexico • Washington, D.C.

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

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Classified ads 505-844-4902

Published on alternate Fridays by Internal & Digital Communications Dept. 3651, MS 1468



MONUMENTAL — As a Sandia intern sponsored by DOE's Office of Indian Energy Policy and Programs, Rachael (third from left) got to conduct research with (left to right) Sandra Begay of photovoltaics, Diana Fuller and Kimberlyn Cameron in Monument Valley, Arizona, near the Utah state line. (Photo courtesy of DOE)

language and helping to keep it circulating for future generations. I would be remiss if I did not also highlight my Hispanic heritage. My father is from El Salvador, and almost all of his family still live there. I appreciate the high value that Salvadorans place on family relationships. At the same time, the country's extreme poverty and violence trouble me.

I sometimes feel caught between two worlds, which I think is common for people of mixed heritage. This feeling is accentuated during my visits to the Yomba Reservation, particularly when I experience "insider-outsider" dynamics since I didn't grow up on the reservation. Recognizing the amount of privilege in my life has been a great motivator, pushing me to take advantage of the opportunities that I've been given so that I can make my family proud. I have also leaned on my family for support to overcome challenges and help me move forward.

Sandia: A place to make a difference

After receiving a bachelor's degree from Boston University and a master's degree in urban planning from the Pratt Institute in Brooklyn, I wanted to give back to the people and community that have helped me along the way. In fact, I chose my field out of a desire to improve reservation life and encourage people to connect with their cultures.

While conducting my thesis research on renewable energy as an economic development driver for tribes, I was fortunate to be introduced to a Sandia internship program sponsored by DOE's Office of Indian Energy Policy and Programs. Through the program, I met Sandia engineer Sandra Begay. Sandra became my mentor and together we would conduct energy planning sessions with tribes. These planning sessions assist tribal members in evaluating whether renewable energy project development is right for their tribe. As part of my research, I explored whether solar energy was a feasible option for my tribe since the Yomba Reservation has open land drenched with sunlight. However, I learned there are many challenges before solar energy can be brought to a remote area, especially one without a utility infrastructure or plan-

ning department. Running lines is expensive and requires a commitment from a company to purchase the generated power. There were also cultural barriers to the idea of harvesting energy from the sun, and explaining solar technology to tribal members was difficult. After graduation, I accepted Sandia's offer to continue to work with Sandra as a year-round intern. A few months later, I jumped at the opportunity to be a strategic planner at Sandia/California and am happy to be closer to my family in Sacramento.

Full STEM ahead

A wide range of potential professions are available under the STEM umbrella. When highlighting STEM careers to young Native Americans and other minority-group members, I share my own experiences.



CALIFORNIA SUNSHINE — The Sandia team works on a solar installation at Blue Lake Rancheria, east of Arcata in northern California. (Photo courtesy of DOE)

I then advise younger people to cultivate their curiosities and carve out their own niche by combining STEM with other disciplines. I also encourage them to reach out to people they admire to learn about different career journeys, while reminding students that there is no one "right" path. In the future, I intend to work with Lawrence Livermore National Laboratory's American Indian Activities Group to support Native American heritage, culture and tradition. I am also exploring opportunities with the Livermore Indian Center to help plan STEM afterschool activities for Native American youth.

Take a Turkey to Work 2018

COLD TURKEY DROP OFF — On a cold morning, ALD Mark Sellers and Jacque Ramirez welcomed turkey takers donating to Take a Turkey to Work Day. Members of the workforce donated more than 250 frozen turkeys to Roadrunner Food Bank. The birds will find their way to the tables of hungry families throughout the holiday season. (Photos by Tineca Quintana)

TAKING TURKEYS — Robert Naranjo and other volunteers from Sandia facilities gathered turkeys from collection sites throughout the Labs and shuttled them to the main Roadrunner facility.

Sandians help future STEM leaders

By Kayla Norris

A team of Sandians from the California site volunteered their time Nov. 2 for STEM Day at the Lab, hosted by Lawrence Livermore National Laboratory.

The Sandia team helped motivate and inspire more than 100 eighth-graders from across the San Joaquin Valley to become excited about science, technology, engineering and mathematics and possible future STEM careers. Additionally, the Sandia crew shared some of their work.

STEM Day at the Lab was established in 2015 to emphasize the importance of expanding access to high-quality STEM and computer science education, particularly among historically underserved youth. The event seeks to continue inspiring passion for STEM by exposing students to research in an organizational setting and providing them access to seeing, hearing about and experiencing STEM-related careers.

To volunteer for future events, contact Sandia/California's community relations specialist Kayla Norris 925-294-3585.

NO OPTICAL ILLUSION — Students had the opportunity to learn about optics and see themselves through Sandia's infrared imaging camera, thanks to Sandia retiree Joel Lipkin. (Photo by Kayla Norris)



Sandia California News



Society of Women Engineers presents Achievement Award to Jackie Chen

Penny Wirsing, president of the Society of Women Engineers, presents Jackie Chen with an Achievement Award at the society's recent annual conference, WE18, in Minneapolis. Jackie received the award for her impact on society and the engineering community. The award is the highest honor given by the society and recognizes at least 20 years of outstanding technical contributions to the field of engineering.

(Photo courtesy of the Society of Women Engineers)

Astra supercomputer at Sandia Labs is fastest Arm-based machine on TOP500 list

Success suggests additional chip suppliers for supercomputing industry

By Neal Singer

Sandia's Astra is the world's fastest Arm-based supercomputer according to the just released TOP500 list, the supercomputer industry's standard.

With a speed of 1.529 petaflops, Astra placed 203rd on a ranking of top computers announced at SC18, the International Conference for High Performance Computing, Networking, Storage, and Analysis, in Dallas.

A petaflop is a unit of computing speed equal to one thousand million million (10¹⁵) floating-point operations per second. Astra achieved this speed on the High-Performance Linpack benchmark.

The Sandia supercomputer is also ranked 36th on the High-Performance Conjugate Gradients, a different benchmark co-developed by Sandia and the University of Tennessee, Knoxville, with a performance of 66.942 teraflops. One thousand teraflops equals one petaflop.

The latter test uses computational and data access patterns that more closely match the simulation codes used by NNSA.

Astra is one of the first supercomputers to use processors based on Arm technology. The machine's success means the supercomputing industry may have found a new potential supplier of supercomputer processors, since Arm designs are available for licensing.

Arm processors previously had been used exclusively for low-power mobile computers, including cell phones and tablets. A single Astra node is roughly one hundred times faster than a modern Arm-based cell phone, and Astra has 2,592 nodes.

"These preliminary results demonstrate that Arm-based processors are competitive for high-performance computing. They also position Astra as the



BIG IRON — The Astra supercomputer at Sandia, which runs on Arm processors, is the first result of the Labs' Vanguard program, tasked to explore emerging techniques in supercomputing. The supercomputer is now ranked as the 203rd fastest in the world, based on its speed running the High-Performance Linpack benchmark, and 36th fastest on the High-Performance Conjugate Gradients benchmark.

(Photo by Regina Valenzuela)

world leader in this architecture category," said Sandia computer architect James Laros, Astra project lead. "We expect to improve on these benchmark results and demonstrate the applicability of this architecture for NNSA's mission codes at supercomputer scale."

Less than a month after hardware delivery and system installation, Astra reached its first goal of running programs concurrently on thousands of nodes.

The next steps include transferring NNSA mission codes to Astra from existing architectures. While Laros said this step can be challenging for Astra's new architecture and compilers, the real effort will likely involve a continuous cycle of performance analysis, optimization and scalability studies, which evaluate performance on larger and larger node counts to achieve the best possible performance on this architecture.

"We expect that the additional memory bandwidth provided by this node architecture will lead to addi-

tional performance on our mission codes, which are traditionally memory bandwidth limited," said James. "We ultimately need to answer the question: is this architecture viable to support our mission needs?"

The Astra supercomputer is itself the first deployment of Sandia's Vanguard program to evaluate the viability of emerging high-performance computing technologies in support of the NNSA's mission to maintain and enhance the safety, security and effectiveness of the U.S. nuclear stockpile.

Astra was built and integrated by Hewlett Packard Enterprises, and is comprised of 5,184 Cavium ThunderX2 central processing units, each with 28 processing cores based on the Arm V8 64-bit core architecture.

"While being the fastest in the world is not the goal of Astra or the Vanguard program in general, Astra is indeed the fastest Arm-based supercomputer today," James said.

technical expertise

(Continued from page 1)

ordnance disposal groups. Ultimately, this will improve awareness of the technical expertise ARG brings to the table, should an accident happen.

“Our weapons are the safest in the world,” said Dan Summers, a longtime ARG volunteer who has focused on nuclear weapons surety for decades. “They have tremendous safety features, and we consider a variety of accident conditions when designing and testing them, including fire, crushing damage, even weather events.”

ARG safely assesses, recovers nuclear weapons damaged in accidents

ARG brings together diverse experts in nuclear weapons and health and safety from Sandia, Lawrence Livermore and Los Alamos national laboratories as well as the Remote Sensing Laboratory and Pantex Plant. Each facility has its own area of expertise. The physics labs — Los Alamos and Lawrence Livermore — focus on the nuclear package. As the nuclear engineering lab, Sandia focuses on the whole weapon, Bill said.

ARG is a group of volunteer emergency responders, like a volunteer fire department, made up of experts at the top of their field.

Volunteers are on call on a rotating basis for the initial phase of response. If necessary for a safe recovery, ARG can expand to a team of about 50 experts for round-the-clock field operations.

ARG is one of many NNSA nuclear and radiological emergency response groups. Sandia is also heavily involved in the 60-year-old Radiological Assistance Program, which shares a lot of experts and expertise with ARG.

Experts from across the nuclear enterprise need to be nominated by current members of ARG or weapons systems program leadership before they can volunteer. “We want the folks who handle the routine technical challenges of the nuclear weapon systems to be a part of ARG,” Harry said.

Ryan Kristensen was nominated for ARG about four years ago. A systems engineer, he started working with some ARG volunteers on a specific project. Through them he learned about ARG’s critical mission. Bill said, “Ryan Kristensen is a great example of what ARG is becoming. He is a highly skilled engineer and is bringing a new, fresh perspective to ARG.”



DRILL, DRILL, DRILL — ARG responders practice weapon assessment and recovery during a drill at Sandia. (Photo by Mark Olona)

For Ryan, the most fulfilling part of volunteering for ARG is working as a team in the field during exercises. “It’s great when you can come together and achieve a difficult task. It’s not often you can work with a team like that and know you’ve made a difference,” he said.

Emergency responders provide technical expertise to Explosive Ordnance Disposal

ARG regularly participates in emergency exercises designed to test everything from equipment and deployment times to collaboration with other agencies, such as the DoD and FBI. These exercises involve highly realistic models but no actual nuclear weapons.

“During an exercise or real-world event, we’re not Sandia, Los Alamos or Lawrence Livermore; we’re ARG,” Ryan said. The boundaries between DoD and DOE responders relax as well, he said. “Explosive Ordnance Disposal are the hands-on guys, and we ensure what they do is safe for them and the weapon.”

These exercises test the ARG responders’ limits too. During an exercise in 2005, Dan had to splice a damaged fiber optic cable in winds more than 75 mph, while wearing a full protective suit, in order to restore ARG’s secure communications system. “If you don’t practice for real, you’re never going to be ready,” Dan said.

Ryan thinks the post-exercise debrief and celebration is also an important part of building bonds between responders from across the nuclear enterprise and agencies for the next exercise or real-world event.

‘Home Team’ provides expert knowledge and support

In addition to the field responders, ARG also provides technical support in the form of the Home Team, a collaborative network with

nodes across the nuclear enterprise and at NNSA headquarters. They serve as a conduit to the enterprise’s technical experts, which can be tailored to the exact weapon system and the precise damage caused by the accident.

“The ARG responders in the field have secure, reliable, dedicated, high-speed communications with the Home Team and the precise experts needed,” said Brenda Townsend, who has been a member of Sandia’s Home Team for 15 years. This communication allows ARG to deploy far fewer people to the site of an accident, which is cost effective.

In addition to the weapons systems experts, the Home Team includes a team responsible for double-checking the weapon recovery plans, a team that ensures the communication networks work effectively and a team that handles the logistics of getting the ARG responders to the site of the accident and making sure they have everything they need when they arrive, such as hotel rooms.

Brenda serves primarily as a communications specialist, but she’s also responsible for staffing the communications and logistics positions. She said, “I really believe in ARG’s mission. It gives me satisfaction to provide the substructure to allow ARG to do its job efficiently and effectively.”

Sandia’s Home Team is the lead Home Team and can coordinate requests for information from the field or headquarters with other Home Teams with the right expertise. The Home Teams use secure phone lines, video conferencing and even instant messaging to communicate with each other, responders in the field and with DOE and DoD.

This secure communication is aided by a portable integrated video system, or PIVS. This secure fiber optic based communications system can carry video and audio from the accident area to the Home Teams. The volunteers responsible for setting up the system and hauling the 85-pound reels of fiber optic cables are colorfully called PIVS mules. Harry was a PIVS mule during his first exercise, almost 25 years ago.

“Once I got out to the exercise, the importance of it got ahold of me. The important mission either resonates with you as a scientist or engineer or it doesn’t. And it certainly resonated with me,” Harry said, adding, “Every accident situation is unique so every response is somewhat unique, so it’s intellectually stimulating too.”

CRADA enables resilient microgrid

(Continued from page 1)

away and DC power systems or microgrids will form a large part of the country’s energy needs.”

Sandia’s advanced toolkits

DC microgrids still face some technology gaps, but Sandia researchers have been studying control and stability of DC microgrids for military applications for over a decade, hoping to optimize design and performance at a lower cost, Abraham said.

“Power electronics and other technologies make it possible to move energy around in ways that are now much more efficient. It’s safer, cleaner, more economical, more reliable and more resilient.”

— Rob Bennett
Emera Technologies CEO

Working with Emera Technologies gives Sandia the ability to extend the research beyond the military. Emera Technologies also will help upgrade existing toolkits and capabilities including Sandia’s Secure Scalable Microgrid Testbed, the Distributed Energy Technologies Laboratory, the Virtual Power Plant and the Microgrid Design Toolkit, said principal investigator Jack Flicker.

The SSM is a research facility housing three interconnected DC microgrids, and DETL is used for research on energy systems integration. The testbed and

DETL develop technologies to solve complex electrical energy challenges, such as unpredictable changes in renewable energy sources due to variables like clouds or lack of wind.

These make it difficult for a power system to operate and provide enough electricity for the demand, especially unpredictable demands.

Jack said scientists are developing models for Emera and validating them at the testbeds. The Secure Scalable Microgrid Testbed and Distributed Energy Technologies Laboratory have been used extensively for such applications as advanced power electronics development for the Navy’s electric warships, and could be used by other companies.

Sandia’s Virtual Power Plant is a software that anticipates performance by renewable energy sources and storage mechanisms and determines how to optimize operations and balance power loads.

The Microgrid Design Toolkit looks at the optimal layout of a microgrid, its topology, performance, reliability and resilience. Sandia has used it to optimize microgrid design at Army bases, Jack said.

Partners envision energy future

“There are demonstrated vulnerabilities with the grid in the United States and elsewhere. Large scale outages that have recently impacted the electricity supply for entire islands are very good examples of the type of problems we need to prevent or mitigate for the safety and security of our country. With this CRADA we’re trying to address what the future of energy is going to look like,” said Sandia program manager Amy Halloran.



RESEARCH PARTNERS — Sandia associate labs director Dori Ellis shakes hands with Emera Technologies CEO Rob Bennett following the signing of a Cooperative Research and Development Agreement between the Laboratories and the utility company.

(Photo by Lonnie Anderson)

Emera invests in electricity generation, transmission and distribution, gas transmission and distribution, and utility services focused on low carbon energy sources. The company has investments throughout North America and in four Caribbean countries.

“The way we operate power systems around the world today is based on technology that, for the most part, is a hundred years old,” Bennett said. “Power electronics and other technologies make it possible to move energy around in ways that are now much more efficient. It’s safer, cleaner, more economical, more reliable and more resilient.”

Bennett said he envisions microgrids serving communities at the edge of interconnected grids, as well as portions of the grid being turned into microgrids. Eventually the need for central generation systems will diminish and, instead, communities will function using their own microgrids.

“Having access to clean and reliable energy everywhere at all times is a good thing, but it’s also a challenge,” Abraham said. “Opting for a DC solution requires a bit of imagination. We’ve been working on pieces of this technology for a long time, and we welcome the opportunity to bring this together.”

2018 HENAAC Luminary Mark Rodriguez



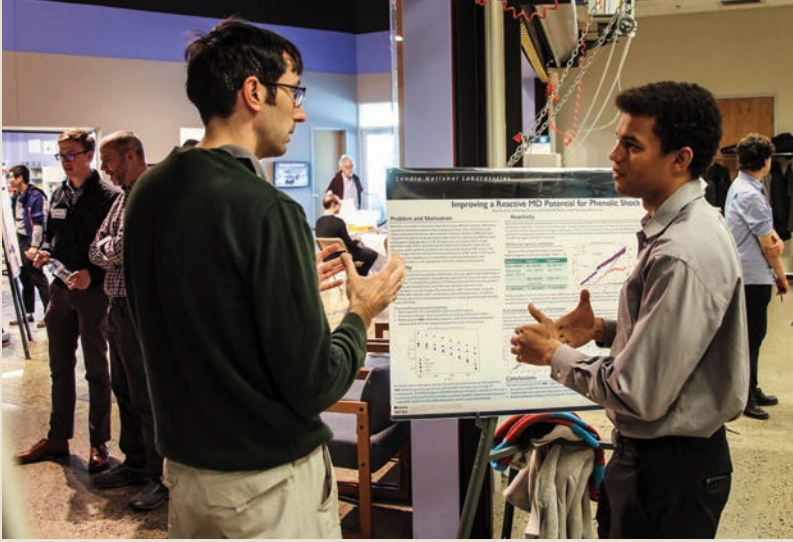
SEEING INSIDE — Mark Rodriguez, HENAAC Luminary, poses with one of his favorite instruments, the Single Crystal X-ray Diffractometer in the Sandia X-ray laboratory. (Photo by Randy Montoya)

Sandia materials scientist Mark Rodriguez recently received the Luminary Award at the Great Minds in STEM Hispanic Engineer National Achievement Awards Conference. Luminary honorees are professionals in science, technology, engineering and mathematics who initiate, collaborate and lead key programs and research and make significant contributions to the Hispanic technical community as leaders and role models. In her nomination letter, Blythe Clark, Mark’s manager, wrote that “his commitment to giving back to the scientific community makes him truly worthy of being a role model to others.” And Labs Director Steve Younger called Mark “an inspiring scientist whose career and commitment to his community are impressive.” Mark started at Sandia as a postdoctoral fellow 24 years ago and is now a leader in the field of X-ray diffraction, recognized for his work characterizing new materials. He’s published more than 250 technical articles and been granted eight patents, and frequently instructs others in X-ray diffraction analysis. Mark won the DOE Advanced Technology Development program award for his development of in-situ X-ray characterization methods for battery cathode materials; the Meritorious Achievement award for addressing hermetic seal failures; and a Sandia Award of Excellence for his outstanding contribution to the Micron project for the National Center for Advanced Information Component Manufacturing. He was also instrumental in the development and commissioning of the High-Pressure Preferred Orientation neutron spectrometer for the Los Alamos Neutron Science Center. A Fellow of the International Centre for Diffraction Data for nearly a decade, Mark has served in a variety of director and chairman roles for the organization. His recent research has focused on virtual reality for enhanced diagnostics of micro-computed tomography datasets and 3D X-ray diffraction datasets, taking advantage of low-cost VR headsets and improved graphics processing to view massive amounts of data. Mark volunteers with MANOS Hands-on Science and Engineering Program and Hispanic Outreach for Leadership and Awareness and has coached youth soccer. He’s also taught Newton’s laws at the Rio Rancho Boys/Girls Club and has served as a science fair judge and volunteer instructor, bringing STEM education to underserved students. Mark holds a bachelor’s and doctorate in ceramic engineering from Alfred University in Alfred, New York. — *Jim Danneskiold*

Postdoc Technical Showcase



Postdoctoral fellows from across the Labs joined colleagues and managers at the National Museum of Nuclear Science and History Nov. 14 for the 12th annual post-doctoral technical showcase, sponsored by the Sandia Postdoctoral Development Association. Peter Dickens (right, photo at top left) discusses his research in the important field of ultra-wide-bandgap transistors with Deputy Labs Director Dave Douglass, and Keith Jones (lower photo, right) explains how his molecular dynamics simulation better represents phenolics during the half-day proceedings, which included presentation of the association’s distinguished mentorship award to Todd Monson of nanosciences. Judges chose Highly Nonlinear III-V Semiconductor Meta-surfaces by Polina Vabishchevich (right, photo at top right) as the best of the 33 posters. Runners-up were Matthew Lim, Stephen Percival and Raktim Sarma in a dead heat. (Photos by Lonnie Anderson)



Larry Luna elected American Society of Mechanical Engineers fellow

By Michael J. Baker

Sandia engineer Larry Luna has been elected a fellow of the American Society of Mechanical Engineers for significant achievements during more than 30 years of service and leadership. “I am pretty excited about it,” Larry said. “I think the fellow designation is a great honor in that it’s a recognition of what I’ve accomplished in my professional career and with ASME.” Larry was promoted to fellow at the ASME International Mechanical Engineering Congress and Exposition on Nov. 10 in Pittsburgh. ASME fellows constitute about 3.5 percent of the organization’s more than 95,000 members. Larry was specifically recognized “for his contributions to the national security of the United States,” according to ASME. “This is really a reflection of the career-long commitment by Larry to ASME and engineering,” said Shawn Burns, who is Larry’s manager and has known him for about 15 years. “He’s taken on several different roles and leadership positions within ASME. This is not only about his technical ability, but also his dedication to the profession of mechanical engineering.” **Long service to Sandia mission** After receiving a bachelor’s in mechanical engineering from the University of New Mexico and interning at Sandia, Larry’s first day of employment at Sandia was in January 1992. He received a master’s in engineering mechanics from New Mexico Tech while working at Sandia. Larry has held several different positions during his tenure.

“I’m really thankful for the diversity of experience I’ve been able to achieve working at the Labs,” Larry said. “I’m really thankful for my colleagues here and from other places whom I’ve gotten to work with over the course of my career.” Larry led teams of analysts, designers and experimentalists in developing and testing restraint systems for cargo. He led a project to upgrade safety systems in the trailers that transport nuclear materials and participated in the development of next generation armored tractors. Larry also led several other national security projects for the departments of Energy and Defense. Larry served for seven years as a program manager for the DOE Nuclear Explosive Safety Studies program, which provides the final safety review for operations



ASME FELLOW — Sandia engineer Larry Luna has been named a fellow of the American Society of Mechanical Engineers. Larry earned the honor for his contributions to national security. (Photo by Lonnie Anderson)

within NNSA prior to the start of production. Larry also served as a nuclear safety engineer and led teams assessing the nuclear safety, surveillance, quality and reliability of proposed weapons systems modifications. Recently, Larry has been part of a group implementing advanced manufacturing methods at Sandia and has led several teams focused on improving the timeline for the development and modernization of the nuclear deterrent. Larry currently assists in coordinating Sandia’s engagement with international partners. Larry’s leadership and program management has led to many recognitions: the DOE Performance Excellence Award in 1999; the Defense Programs Award of Excellence in 2008, 2013 and again in 2017; and the Sandia Executive Office Certificate for Leadership in 2012. **Decades of ASME leadership** An active member for 30 years, Larry’s ASME career began as a student at UNM. Throughout his engineering career, he took on greater volunteer responsibilities, holding many leadership positions in the New Mexico Section and Rocky Mountain Region. He also has supported the society’s membership training activities and held national leadership roles on the National Nomination Committee and the Committee on Organization and Rules. Larry’s ASME contributions were recognized with the ASME Distinguished Service Award in 2012. It is the election to fellow that makes Larry particularly proud, he said. “It’s quite humbling and quite exciting. Just to be considered for nomination is a high honor.”

Mileposts



New Mexico photos
by Michelle Fleming

California photos
by Randy Wong



Larry Carrillo 40



Ron Akau 35



Douglas Dederman 35



Mike Dvorack 35



Rebecca Darnell Horton 35



James Kajder 35



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Harry Cincotta 30



Paul Graham 30



John Brewer 25



Ruth Harris 25



Tom Kulp 25



James Lucero 25



Dominic V. Martinez 25



Jim Novak 25



Ron Baker 20



Michael Chandross 20



Patricia Crossno 20



Linda Flores 20



Daniel Frampton 20



Brian Gutierrez 20



John Hewson 20



Russ Jarek 20



Gerald Langwell 20



Chris Mauro 20



Janet Philippsen 20



James Romero 20



Patsy Trujillo 20



Caren Wenner 20



Nicole Beenau 15



Zach Benz 15



Jeff Brewer 15



Joe Carney 15



Denise Fleming 15



Harriet Haibek 15



Bruce Hamilton 15



Nichole Jaramillo 15



Lavone Jones 15



Sofia Marrufo 15

SANDIA CLASSIFIED ADS

Note: Dec. 7 will be the final issue of the Lab News for 2018; there will be no Lab News on Dec. 21. The Classified Ad deadline for the January 4, 2019, Lab News will be Thursday, Dec. 20 at noon.

MISCELLANEOUS

PEAVY TKO 115 AMP, 7 band EQ, effects & preamp send/receive, 15-in. Black Widow speaker, in Rio Rancho. Fleming, 505-994-0808, leave message.

YOUNG AT HEART CHRISTMAS MARKET/CONCERTS, Nov. 30-Dec. 1 and Dec. 7-8, 8401 Paseo del Norte. Martin, 281-7227.

'KINKY BOOTS' TICKETS, 2, Popejoy, March 10, 2019, 6:30 p.m., orchestra seats, east side, row P, inside aisle, \$63.75 ea. Hoyal, 505-823-1421.

DRY BAR, handmade, w/marble tile, 8'2" x 2'6" x 3'10", w/4 bar stools & 2 bar chairs, \$1,200. McDonald, 505-720-0592.

GEORGE FOREMAN GRILLING MACHINE, model GRP472P, removable plates, 5-serving, gently used, w/manual, \$28. Wagner, 505-504-8783.

FEMALE BLACK LAB, 4 yrs. old, 60-lbs., trained, calm, loving, good w/most dogs & kids, \$200 donation required to Animal Humane, text for more info. Ries, 507-995-8972.

RECUMBENT EXERCISE BIKE, Pro-Form 80, w/fan & screen, good condition, \$100. Pfeiffer, 505-299-3951.

STANDING MIRROR, wooden, oval, vintage-style, like new condition, photo available, \$50. Krapcha, krapcha6275@comcast.net.

SCOUT CARGO TRAILER, small, w/hitch, bracket for cooler/tool box, \$350; generator 110-W, \$700; Craftsman tractor w/attachments, \$75; in East Mountains. Willmas, 505-907-9324, djwillmas@gmail.com.

TABLE LAMP, Waterford Crystal, antique bronze, like new, https://tinyurl.com/y9kxlkun, retails \$845, asking \$650. Vigil, 575-386-6377.

DUTY PACKS: Cannae Pro Gear Phalanx, Coyote, w/helmet carry, 30 L Main; transport bag, black, 60 L; brand new. Pacheco, 505-816-8501, text for photos.

SPEAKERS, Definitive Technology Mythos Two, 2 tabletop, 1 center/wall mount, excellent condition, \$300. Hall, 573-8609.

TRANSPORTATION

'16 SUBARU WRX PREMIUM, lots of upgrades, clean, garaged, non-smoker, 36K miles, 10K on built motor. Martin, 806-206-1739.

'16 FORD F150 XLT, 4x4, supercrew, 3.5L Ecoboost, FX4 off-road pkg., tow pkg., navigation, 36-gal. tank, 27K miles, \$31,500. White, 505-238-2437.

'91 TOYOTA PICKUP, 4x4, regular cab, brown, blown 3.0L V6, otherwise works, engine swap to classic, \$1,299 OBO. Payne, eubankpayne@gmail.com.

RECREATION

'13 CAM AM SPYDER RT, only 6.4K miles, like new, \$15,000. Hill, 505-633-4162.

'12 YAMAHA FZ6 SPORT BIKE, 600 cc, 4K miles, great shape, clean title. Long, 505-554-5747.

TRUCK POP-UP CAMPER, heater gas/electric, sleeps 3, AC, gas cook top, fits 7-ft. truck bed, \$4,200. Hibray, 505-620-1572.

'97 LANCE CAMPER, 185S, short-bed, new battery/water heater, solar, awning, backup camera, everything works, great condition, \$4,200 OBO. Swanson, 505-275-9495.

REAL ESTATE

3-BDR. HOME, 2 baths, 1,454-sq. ft., 1 story, new carpet & paint, 8605 Casa Vistosa Ct. NW, \$179,000. Stotz-Harrell, 505-238-1001.

1-BDR. CONDO, totally renovated, granite countertops, all new appliances, balconies, courtyard view, covered assigned parking, pool, club house, more, \$95,000. Goodson, 505-407-1688.

3-BDR. HOME, 2-3/4 baths, 2-car garage, 2,738-sq. ft., lots of upgrades, Encanto Village, gated community, 7439 Via Cometa SW, MLS#928335, \$249,000. Vigil, 505-514-6647, ask for Donna.

3-BDR. HOME, 2 baths, open floor plan, 100% updated, Far NE, 8233 Colfax Ave. Martinez, 718-9274.

4-BDR. HOME, 3 baths, 3,032-sq. ft., custom home, built in 2017, Petroglyph Estates, 6535 Vista Del Prado NW, MLS #930574, \$550,000. Gallegos, 505-340-7544.

How to submit a classified ad

DEADLINE: Friday noon before the week of publication unless changed by holiday. Submit by one of these methods:

- EMAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 505-844-0645
- MAIL: MS 1468 (Dept. 3651)
- INTERNAL WEB: Click on the News tab at the top of the Tech-web homepage. At the bottom of the NewsCenter page, click the "Submit a Classified Ad" button and complete the form.

Questions to Michelle Fleming at 505-844-4902.

Due to space constraints, ads will be printed on a first-come, first-served basis.

3-BDR. HOME, 3 baths, 1,660-sq. ft., 5121 Noreen Drive NE, MLS#931444, \$258,000. Giar, ryangiar@gmail.com.

WANTED

ROOMMATE, master bdr. available, semi-furnished home, Uptown, \$650/mo., Singh, 512-905-8632, ask for Bismark.

LEGOS, for 3 kids for Christmas, any sets, any condition. Beckett, 480-332-3748.

CHIHUAHUA MIX or longhaired Chihuahua, small, 4-8-lbs., healthy, female, adult, >6 yrs. old. Sutton, 505-298-0001.



CRADA boom

(Continued from page 1)

national security and defense, small business and large business" said Sandia technology partnerships senior manager Mary Monson. "CRADA research furthers the research capabilities of both parties and fosters innovation."

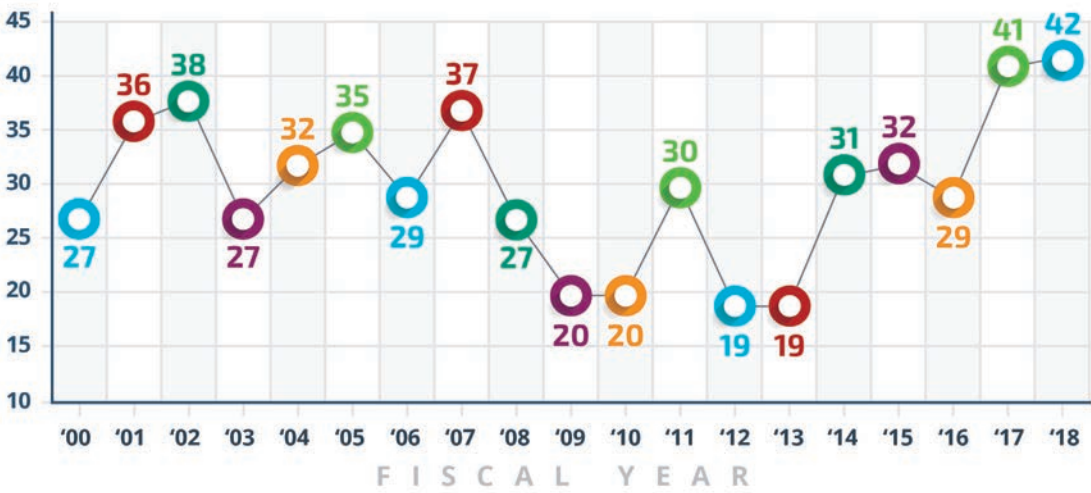
The Stevenson-Wydler Technology Innovation Act of 1980 created CRADAs. A standard CRADA covers a single project in one technical area, and an umbrella covers multiple projects and technologies. Most CRADAs last one to three years, but some can last many more.

"We have some very long-term CRADAs, such as the one with Goodyear," Mary said. Sandia and The Goodyear Tire & Rubber Co. have worked together since 1992 and signed their first CRADA in September 1993 to create better tires and more advanced computational mechanics.

Funding for the collaborations can come from several sources: A company pays to work with Sandia; or the partners use DOE work authorization funds allocated to the labs; or the funding comes from another federal agency or Laboratory Directed Research and Development, both of which fall into the in-kind category. CRADA contract values range from \$50,000 to multimillions.

CRADAs allow access to facilities and technology that might otherwise be unaffordable for smaller businesses or education institutions, while at the same time allowing them to bring innovations to the public, Jason said.

TOTAL NEW CRADAS BY FISCAL YEAR



"Sandia CRADAs have developed into a really good return on investment for taxpayers."

Variety is the spice of CRADA

Several new CRADAs in fiscal year 2018 demonstrate the diversity of partnerships and scope of the agreements.

Local presence: Sandia signed a CRADA with Emera Technologies Ltd., a subsidiary of Emera Inc., a Canadian-based energy and utility company with an office in New Mexico. The CRADA will enable work on a small-scale direct-current microgrid that will locally manage

storage and resources, such as solar, wind and thermal systems. (See accompanying story, page 1.)

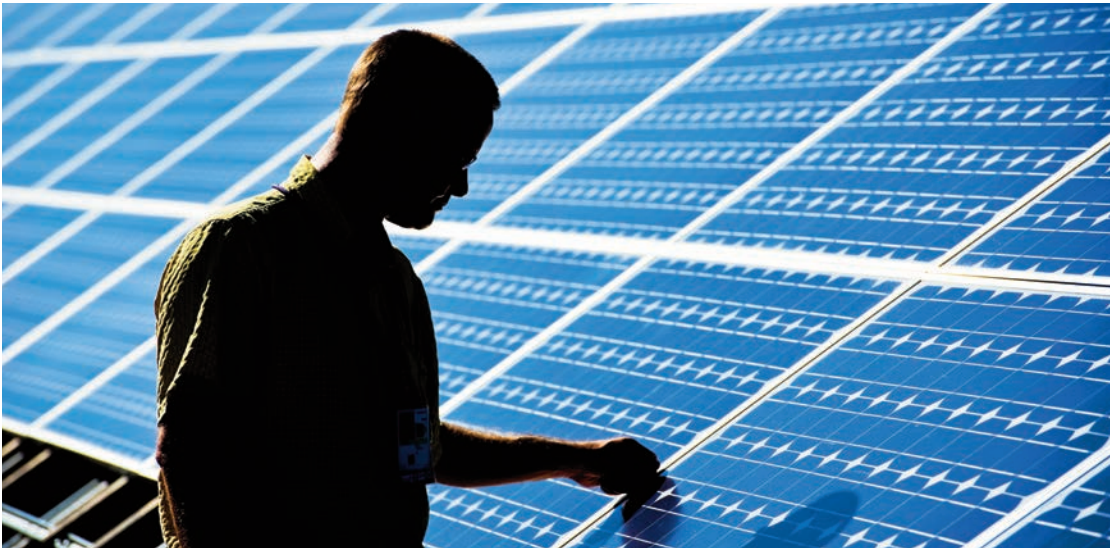
Small business: Sandia and CalWave Power Technologies Inc., are improving the controls of the Berkeley, California-based company's wave-energy converter that absorbs energy from ocean waves.

Educational institutions: The Georgia Tech Research Institute and Sandia agreed to an umbrella CRADA to work on the evolving makeup of the nation's research landscape; the nation's economy and security; the challenge of attracting, growing and retaining qualified researchers; the funding mechanisms for solving such big problems; and the benefits of collaboratively creating and disseminating new ideas and technologies.

Nonprofit groups: Sandia and the Electric Power Research Institute, based in Palo Alto, California, are collaborating to provide insight into high-voltage arc-fault phenomena in photovoltaic systems. The rapid release of heat, pressure waves and electromagnetic interference from an arc-flash poses risks to people and equipment in photovoltaic plants.

Foreign agencies: Sandia and the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt), Germany's national aeronautics and space research center, are working on renewable, concentrating-solar-power technologies to further the understanding of materials and processes that underpin advanced systems for harvesting and storing solar energy.

"We're always looking to expand our base," Jason said. "Whether a small or large institution, the innovation impact can be very great."



Rubber-powered world champ

Sandian holds two world records flying model aircraft



FRAGILE FLYER — Brett Sanborn holds two world records for F1D models of indoor rubber-powered aircraft, fragile lightweight flyers with the fuselage, tail boom, wing, stabilizer and rudder constructed from balsa wood and reinforced in different places with boron fibers. (Photo by Randy Montoya)

By Michael J. Baker

Releasing the gossamer-winged aircraft, Brett Sanborn loses control. All he can do after it gently leaves his grasp is watch, hoping it doesn't collide with anything or get snagged by a patch of cool air as it slowly climbs, flattens out, circles and then descends.

If he's done it right, it will be a successful flight of his indoor rubber-powered model aircraft. And Brett has done it right many times — including two world-record and world-championship times.

"You can mechanically preprogram some of the flight, mainly programming for a big circle," says Brett, an environment mechanical engineer at Sandia. "After you let it go, you really don't have any control."

Light, lean and slow

Brett holds two world records for F1D models of indoor rubber-powered aircraft, fragile lightweight flyers with the fuselage, tail boom, wing, stabilizer and rudder constructed from balsa wood and reinforced in different places with boron fibers. The wing, stabilizer and rudder are covered with ultrathin Mylar, 0.5 micrometers, giving the aircraft a near-transparent look. The idea is to make it as light as possible but no lighter than the minimum-allowed 1.4 grams, about a half gram more than a U.S. dollar bill weighs. Wingspans are limited to 55 centimeters (21.65 inches), wing chords to 20 centimeters (7.87 inches) and horizontal stabilizers to 45 centimeters (17.72 inches).

"Of course, the idea is to get as close to that as possible," Brett says. "Construction of one model takes on the order of 40-50 hours."

A rubber motor has a separate weight requirement of a maximum of 0.4 grams. Before flight, he winds the rubber about 1,300 turns. The flight is launched by hand from the floor, flies at a speed of 2-3 feet per second, with the propeller turning at 50 revolutions per minute. In comparison, a typical passenger car will idle between 600 to 1,000 rpm.

"The propeller turns throughout the entire flight. There is no glide time," Brett says. "Improvements in flight time are gained by better matching the rubber motor properties — thickness, length, total turns, torque — and adjusting the propeller — high and low pitch settings, diameter, pitch transition timing."

Twice in the last two years, Brett has matched these properties better than anyone else before him.

Records and championships

On Sept. 3, 2017, Brett flew his craft for 32 minutes, 9 seconds, eclipsing the previous record for a flight above 100 feet by about 2.5 minutes. At Hanger 1 in Lakehurst, New Jersey, famous for being the crash site of the Hindenburg, he launched the world-record flight from the floor and the tiny aircraft climbed for 10 minutes to just below the rafters at roughly 165 feet. A slight drift pushed the model toward a wall, but the plane continued to cruise for 10-11 minutes before descending and claiming the record.

Brett's second world record came on March 22 at the F1D World Championships in the 1901 atrium of the West Baden Springs Hotel in Indiana. Competitors had six rounds over three days, with the best two flight times added together for a total. The top totals of three competitors from a country are added together for the team championship.

Rounds 1-3 were plagued by bad weather. Snow on

the roof and cool conditions inside caused thermals at different spots, Brett says. "The model would get caught in a thermal and climb to the top in less than two minutes. A half circle and about three minutes later, the model would be on the floor due to sinking air."

The sun shone during round four, heating the roof and air. Brett seized the opportunity and pulled out his best plane and flew it for 27 minutes, 11 seconds, the longest time in the championship and a new world record for ceiling heights under 100 feet.

"Unfortunately, one needs to fly two consistently good times to win rather than having a single long flight," Brett says. "With only a five-minute flight on the board as my backup, I wasn't even on the podium."

Competitors from Romania and Hungary were ahead on the leaderboard. Brett's fifth-round flight — using his backup plane due to cold weather in the morning — failed to climb to the ceiling, drifted toward a wall and crashed with a time of only 18 minutes.

It came down to the final round. The team gathered and strategized. Brett, with the best chance at an individual title, would fly his best plane and be the last of the team to launch during the warmer afternoon.

Brett's flight eased to its apex in about nine minutes, cruised about 1 foot below the atrium's steel girders and then methodically descended. It landed 27 minutes, 1 second after it had taken off.

Brett claimed the championship, with a total time more than six minutes longer than the second-place Hungarian. Better yet, his teammates had also improved their flight times in the last round and would individually place fifth and sixth, catapulting Team USA to the championship with a total time nearly 20 minutes longer than second place Romania.

"Taking home the individual world champion title as well as the team world champion title is the best result the U.S. could have hoped for," Brett says.

It's about science

Brett started flying rubber-powered models when he entered a Science Olympiad at his Michigan high school. Those first flights would last three to five minutes.

"Science was always an interest," he says.

He continued to fly throughout college and while earning his master's in aerospace engineering from Purdue University in 2011. He's been at Sandia since 2015.

In 2020, he plans to defend his titles at the world championship in Romania, which will be held in a 200-foot tall cathedral-shaped hall built underground in a salt mine.

"It will be a constant 50 degrees," he says. "It's way worse for rubber energy, but we'll be ready."

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